



Genetic Studies for Yield and Component Characters in Germplasm Lines of Safflower

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Variability and association studies were conducted in a set of 75 germplasm lines of safflower received from DOR, Hyderabad. Sufficient variability was present in the germplasm for number of capitula per plant, number of seeds per capitulum and seed yield (kg/ha). The 100 seed weight (g) had high heritability coupled with high genetic advance whereas plant height and number of capitula per plant had high heritability with moderate genetic advance. Number of capitula per plant and number of seeds per capitulum showed positive significant correlation whereas, the remaining characters showed significant negative correlation with seed yield. Number of capitula per plant had maximum direct effect on seed yield and rest of the traits had negative direct effect on seed yield. Number of capitula per plant and number of seeds per capitulum were identified as important yield components; hence, selection should be focused on these traits to improve yield in germplasm lines of safflower.

Key words: Genetic parameters, correlation, path analysis, safflower.

Safflower (*Carthamus tinctorius* L.) is an important oil seed crop of *rabi* season. It is considered to be one of the important sources of healthy cooking oil with high PUFA content (78%). It is a widely adopted oil seed crop which can be grown under residual soil moisture conditions in black soils of deccan plateau. The yield of safflower has been stagnated in the past few years due to lack of suitable high yielding varieties with resistance to major biotic and abiotic stresses. To evolve cultivars with high yield potential, it becomes necessary to study the extent of variability in the available germplasm. The effectiveness of selection depends on the magnitude of variability for yield and component traits. Study of interrelationship among yield and contributing traits is also necessary. When more variables are correlated with yield, it becomes difficult to identify the appropriate traits for selection. In such cases, path analysis provides an effective means for finding out direct and indirect contribution of different component characters towards seed yield. Keeping all these facts in view, the present investigation was planned to study variability and association between yield and its components in germplasm lines of safflower.

Materials and Methods

The experimental material comprised of 75 germplasm lines of safflower received from Directorate of Oilseeds Research, Hyderabad. The experiment was sown in Randomized block design with two replications during *rabi*, 2008-09 at

Agricultural Research Station, Tandur. Each line was accommodated in two rows of 5m length each spaced at 45 cm apart with plant to plant spacing of 20 cm. The recommended package of practices were followed to raise a healthy crop. Data were recorded on days to 50 percent flowering, days to maturity, plant height (cm), number of capitula per plant, number of seeds per capitulum, 100- seed weight (g) and seed yield (kg/ha). Data were subjected to statistical analysis to work out genotypic (GCV) and phenotypic (PCV) coefficients of variation, heritability and genetic advance as percent of mean as per standard methods (Johnson *et al.* 1955). Genotypic and phenotypic coefficients of correlations were computed according to Al-Jibouri *et al.* (1958). The correlations were further partitioned into direct and indirect effects as suggested by Dewey and Lu (1959).

Results and Discussion

Analysis of variance revealed significant differences among the genotypes for all the traits studied. The general mean, range and genetic variability of different parameters presented in Table 1 revealed that sufficient variability presented in the germplasm for days to maturity, number of capitula per plant, number of seeds per capitulum, 100-seed weight and seed yield. This variability could be utilized effectively to develop high yielding cultivars through hybridization followed by selection. Phenotypic coefficient of variation (PCV) was maximum for seed yield followed by number of seeds per capitulum, 100-seed weight, number of

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Table 1. Genetic parameters for various quantitative traits in safflower

Character	Mean	PCV	GCV	Heritability (bs)(%)	GA as % of mean
Days to 50% flowering	80.57	10.02	3.83	14.6	3.02
Days to maturity	110.67	2.96	2.79	89.0	5.43
Plant height (cm)	24.78	24.67	23.69	92.2	46.86
Number of capitula per plant	17.89	30.39	27.34	80.9	50.69
Number of seeds per capitulum	5.38	41.22	13.54	10.8	9.16
100-seed weight (g)	1098.73	32.36	32.36	100.0	66.67
Seed yield (kg/ha)	22.52	84.87	13.93	2.70	4.71

capitula per plant and plant height, whereas days to days to 50 percent flowering and maturity had low estimates of PCV. Similar trend was observed for genotypic coefficient of variation (GCV) for almost all the traits, though they were slightly low compared to PCV. These results were in conformity with the findings of Singh *et al.* (2009) in lentil.

The heritability estimate was the highest for 100-seed weight (100%) followed by plant height (92.2%), days to maturity (89.0%) and number of capitula per plant (80.9%). Days to 50 percent flowering and number of seeds per capitulum showed moderate heritability, whereas seed yield recorded low estimate of heritability. Similar results were reported by Jagtap *et al.* (2006). Though high heritability indicated the effectiveness of selection on the basis of phenotypic performance, it did not show any indication of the amount of genetic progress for selecting the best individuals. The highest genetic advance was observed for 100-

seed weight. Plant height and number of capitula per plant had moderately low values for genetic advance whereas, days to maturity, days to 50 percent flowering and seed yield recorded relatively low estimates of genetic advance. The 100-seed weight had high heritability coupled with high genetic advance which indicated that this character is under additive genetic control and simple selection will be effective for its improvement. Moderately high heritability with moderate genetic advance for number of capitula per plant indicated that simple selection can be used to improve this character. Similar results were reported by the earlier workers Lakha *et al.* (1992).

Genotypic and phenotypic correlation coefficients among different characters are presented in Table 2. At genotypic level association of seed yield was positive and significant with number of capitula per plant and number of seeds per capitulum whereas it was significantly and

Table 2. Genotypic correlation coefficients in safflower

Character	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of capitula per plant	Number of seeds per capitulum	100-seed weight (g)	Seed yield (kg/ha)
Days to 50% flowering	1.0000	0.7692*	0.6537*	0.0685	-0.3202*	-0.3170*	-0.3977*
Days to maturity		1.0000	0.3377*	0.3226*	-0.7562*	0.3067*	-0.3084*
Plant height (cm)			1.0000	0.4271*	-0.2335	0.2446	-0.4385*
Number of capitula per plant				1.0000	-0.0477	-0.1119	0.5337*
Number of seeds per capitulum					1.0000	0.0798	0.4046*
100-seed weight (g)						1.0000	-0.3394
Seed yield (kg/ha)							1.000

*-Significant at 5% level

negatively correlated with days to 50 percent flowering, days to maturity and plant height. This indicated that late flowering genotypes had short reproductive period that resulted in to low yield. Days to 50 percent flowering showed positive significant correlation with days to maturity and plant height, but negative significant correlation with number of seeds per capitula, 100- seed weight and seed yield. Days to maturity exhibited significant positive correlation with plant height, number of capitula per plant and 100-seed weight and negative significant correlation with number of seeds per capitulum and seed yield. This indicates that in late maturing genotypes the number of capitula per plant and size

of seed increased but seeds per capitulum reduced. Plant height had positive significant correlation with number of capitula per plant and 100- seed weight but negatively correlated with number of seeds per capitulum and seed yield. Number of seeds per capitulum showed positive correlation with 100-seed weight. These results were in agreement with the earlier findings of Kubsad *et al.* (2000).

The results obtained from path analysis taking seed yield as dependent variable and other characters as independent variables are presented in Table 3. At genotypic level number of capitula per plant exhibited positive direct effect on seed yield

Table 3. Direct and indirect effects of different traits in safflower

Character / Genotype	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of capitula per plant	Number of seeds per capitulum	100-seed weight (g)	Seed yield (kg/ha)
Days to 50% flowering	-0.4005	-0.3081	-0.0215	-0.0274	0.0128	0.0068	-0.3977*
Days to maturity	-0.0053	-0.0069	-0.0003	-0.0002	0.0005	0.0005	-0.3084*
Plant height (cm)	-0.0072	-0.0051	-0.1345	-0.0171	-0.0045	-0.0060	-0.4385*
Number of capitula per plant	0.0118	0.0039	0.0219	0.1720	-0.0082	-0.0193	0.5337
Number of seeds per capitulum	0.0033	0.0079	-0.0035	0.0050	-0.1042	-0.0083	0.4046*
100-seed weight (g)	0.0002	-0.0001	-0.0006	0.0014	-0.0010	-0.0126	-0.3394

*-Significant at 5% level

(0.1720) resulting in positive association with seed yield. All the characters except number of capitula per plant exhibited negative direct effect on seed yield. Although number of seeds per capitulum had negative direct effect on seed yield, it had positive indirect effect through number of capitula per plant. Similar observations were recorded by Malleshappa *et al.* (1989).

Days to 50 percent flowering, days to maturity and plant height had negative direct effect and negative indirect effect on seed yield through number of capitula per plant, number of seeds per capitulum and 100- seed weight resulting in negative association with seed yield. These results indicated that number of capitula per plant, number of seeds per capitulum and 100- seed weight were important yield contributory characters. The negative contribution of days to 50 percent flowering and days to maturity indicated that our selection criteria should be focused on earliness to improve yield.

On the basis of correlation and path analysis studies it could be concluded that number of capitula per plant, number of seeds per capitulum and 100-seed weight are important yield contributing traits, and hence these should be taken into consideration while selecting desirable genotypes for higher seed yield in safflower. Since, safflower is grown under the receding moisture conditions during *rabi*

season, earliness should also be taken into consideration in selection process.

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